

ORIGINAL ARTICLE

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Changes in uterine size after vaginal delivery and cesarean section determined by vaginal sonography in the puerperium

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Abstract There have been few reports on postpartum changes in the uterus during the three months after delivery. The aim of this study was to evaluate uterine morphological changes in women after vaginal delivery ($n=262-351$) and in women after cesarean section ($n=64-82$) and to evaluate the relation between breast-feeding and parity, and uterine involution at 1 and 3 months postpartum measured by vaginal ultrasonography. There were no significant differences in parity between the vaginal delivery group and the cesarean section group. The length of the uterus at one month (7.93 ± 1.16 cm, mean \pm SD) and, three months (7.03 ± 1.19 cm) and the width of the uterus at three months (3.83 ± 0.94 cm) after delivery in the cesarean section group were greater than in the transvaginal group (7.64 ± 1.03 cm, 6.65 ± 0.99 cm, 3.57 ± 0.62 cm, respectively). Increasing maternal parity was associated slightly with larger uterine size at one month post partum. The length of the uterus of women with a breast-feeding rate of 80% or more per day was 6.35 ± 0.85 cm, and shorter than in women with a rate of 20% or less 7.03 ± 1.04 cm, at three months after delivery. The width of the uterine body of women with a breast-feeding rate of 80% or more per day was 3.32 ± 0.45 cm, and shorter than in women with a rate of 20% or less 3.87 ± 0.66 cm, at 3 months after delivery. Stepwise regression and multiple regression analysis among parity, the history of cesarean section, the breast-feeding rate at one and three months after the delivery, and the restoration of the menses at

three months after the delivery showed that the uterine size at one month after the delivery was related to the cesarean section and that the uterine size at three months after delivery was mostly related to the rate of breast-feeding. These results indicated that uterine involution was related to delivery mode at one and three months postpartum, feeding mode at three months postpartum, the menses restoration, and parity. The rate of breast-feeding was mostly related to the uterine size at three months postpartum.

Key words Puerperium · Involution · Uterus · Delivery mode · Breast-feeding · Ultrasound

Introduction

The puerperium is the period of time between the completion of delivery or delivery of the placenta and membranes, and the return of the reproductive tract to its non-pregnant condition. For all practical purposes this period lasts 6 weeks. The puerperal uterus exhibits a dynamic involution process during the first 2 weeks after delivery according to ultrasonography (US) studies [4, 5], however, there have been few reports on postpartum changes in the uterus during the 3 months after delivery. Postpartum changes in uterine size were evaluated by vaginal US in women after vaginal delivery (VD group) and in women after cesarean section (CS group), and the relations of between breast-feeding, menses restoration, parity, and uterine involution were also evaluated at 1 and 3 months post partum.

Materials and methods

The study population included 351 Japanese puerperants who have no complications which affect on the uterine involution and no past or present history of intrauterine infections after the delivery.

Uterine size after the delivery was compared according to delivery mode: vaginal delivery (351 cases in one month after the delivery, 262 cases in three months after the delivery) or cesarean

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Table 1 Patient background (mean±SD)

Delivery mode	Maternal age [years]	Parity	Week of pregnancy at delivery
1 month after delivery			
vaginal delivery (n=351)	29.16±4.97 ^a	0.56±0.81	39.30±1.38 ^c
cesarean section (n=82)	30.77±5.61 ^b	0.53±0.82	38.00±2.48 ^d
3 months after delivery			
vaginal delivery (n=262)	29.19±4.92 ^e	0.53±0.76	39.24±1.40 ^g
cesarean section (n=64)	30.94±5.28 ^f	0.45±0.73	38.10±2.02 ^h

a vs. b, e vs. f; $p < 0.05$, c vs. d, g vs. h; $p < 0.001$

Table 2 Comparison of uterine size at 1 and 3 months after delivery according to delivery mode (mean±SD)

	Vaginal		Cesarean section		
1 month after delivery	L 7.64±1.03	(n=319)	7.93±1.16	(n=72)	$p < 0.05$
	W 4.47±0.66	(n=319)	4.70±0.86	(n=72)	$p < 0.05$
3 months after delivery	L 6.65±0.99	(n=261)	7.03±1.19	(n=64)	$p < 0.01$
	W 3.57±0.62	(n=261)	3.83±0.94	(n=54)	$p < 0.01$

L distance from the cervix to the fundus of the uterus [cm], W maximum anterior-posterior distance in the uterine body [cm]

Table 3 Comparison of uterine size at 1 and 3 months after delivery according to parity (mean±SD)

	Primipara	Multipara			
		para=1		para=2	
1 month after delivery	L 7.65±1.01 cm (n=186)	7.63±1.09 cm (n=113)	N.S.		
	W 4.41±0.66 cm (n=187)	7.55±0.99 cm (n=76)	N.S.	7.73±1.19 cm (n=31)	N.S.
3 months after delivery		4.58±0.66 cm (n=113)	$p < 0.05$		
	L 6.56±1.02 cm (n=156)	4.47±0.61 cm (n=76)	N.S.	4.87±0.68 cm (n=31)	$p < 0.05$
		6.75±0.93 cm (n=88)	N.S.		
	W 3.55±0.66 cm (n=157)	6.75±0.92 cm (n=60)	N.S.	6.74±0.95 cm (n=25)	N.S.
		3.62±0.56 cm (n=88)	N.S.		
		3.59±0.59 cm (n=60)	N.S.	3.80±0.51 cm (n=25)	N.S.

L distance from the cervix to the funds of the uterus [cm], W maximum anterior-posterior distance in the uterine body [cm]

section (82 cases in one month after the delivery and 64 cases in three months). All of the weeks of pregnancies at delivery were after thirty-five weeks of pregnancy. Cesarean section was performed by making a transverse incision in the lower uterine body and suturing it with VICRYL 0 string. Vaginal US was performed to measure uterine size at one and three months after delivery. The examination was performed with a Mochida Sonovista-ET model MEU-1583 using 5-MHz transducer (Mochida Co. Tokyo, Japan). On the same day, the puerperant was investigated the rate of breast-feeding per day. When all feeding was done by breast-feeding, the breast-feeding rate was recorded as 100%, and when all feeding was done by bottle feeding, the rate was recorded as 0%. Patients with complications such as myoma uteri, adenomyosis, puerperal fever, or systemic diseases were excluded from the investigation. US was performed after urination. Uterine size was recorded as uterine length (L; distance from the cervix to the fundus of the uterus), uterine width (W; the maximum-posterior distance in the uterine body).

Results are shown as means±SD. The group data were analyzed by ANOVA followed by Scheffe's F-test. Differences between means yielding a p value of < 0.05 were considered significant.

Results

The background of the subjects in each of the two groups, the VD group and the CS group, are listed in Ta-

ble 1. There were no significant differences in parity between the VD group and the CS group. The week of pregnancy at delivery was earlier in the CS group than in the VD group. There was no significant difference in the rate of breast-feeding per day in the VD group and the CS group at one month (58% and 53%, respectively), however the breast-feeding rate in the VD group was higher than the CS group at 3 months after delivery (53% and 39%, respectively, $p < 0.05$).

The data for uterine size at one and three months after delivery are shown in Table 2. L and W at one and three months after the delivery in the CS group were greater than in the VD group.

Increasing parity was unassociated with greater uterine length up to 3 months post partum (Table 3). However, when parity was greater than two, increasing parity was associated with greater uterine width of 4.87 cm at one month, as compared to primipara of 4.41 cm.

There were no significant differences in size of the uterus between women breast-fed 80% or more and women who breast-fed 20% or less, at one month after delivery in the VD group (Fig. 1). L in women with a breast-feeding rate of 80% or more per day, was 6.36 ± 0.85 cm, and shorter than in those with a rate of

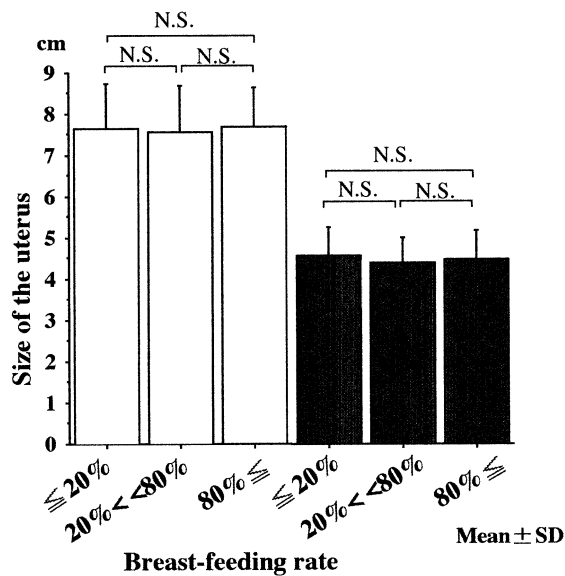


Fig. 1 Uterine size and breast-feeding rate 1 month after delivery. Cesarean section or prior cesarean section cases were excluded, □ length of the uterus, ■ width of the uterus

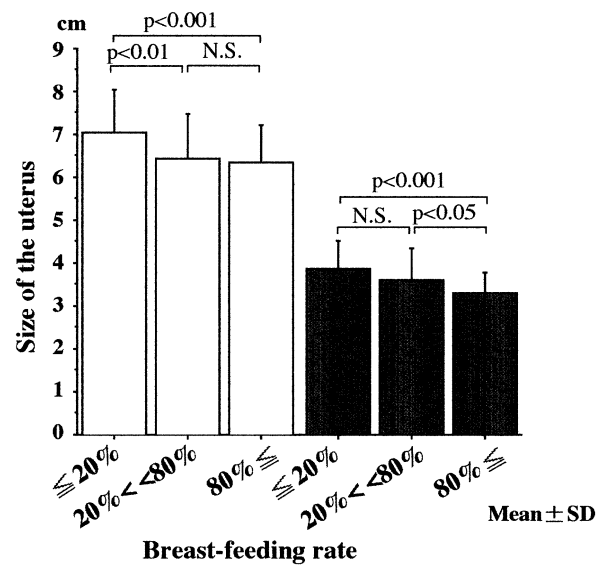


Fig. 2 Uterine size and breast-feeding rate 3 months after delivery. Cesarean section or prior cesarean section cases were excluded, □ length of the uterus, ■ width of the uterus

less than 20%, which was 7.03 ± 1.04 cm, at 3 months after delivery in the VD group (Fig. 2). W in women with a breast-feeding rate of 80% or more was 3.32 ± 0.45 cm and shorter than in that with a rate less than 20%, which was 3.87 ± 0.66 cm at 3 months after delivery in the VD group.

Negative correlation was shown between the size of uterus and breast-feeding rate at three months after delivery in the VD group (L, $r = -0.302$; $p < 0.001$ and W, $r = -0.395$; $p < 0.001$), however, no correlation was found at one month after delivery.

The uterine size of the women whose menses were restored at 3 months after the delivery (L, 7.01 ± 1.01 cm; W, 3.84 ± 0.58 cm) is significantly larger than those whose menses were not restored at 3 months after the delivery (6.49 ± 0.99 cm; 3.43 ± 0.61 cm, $p < 0.0001$, respectively) in VD group.

To estimate the factors which contribute to the uterine, stepwise regression and multiple regression analysis were performed among parity, the history of cesarean section, a breast-feeding rate of one and 3 months after the delivery, and the restoration of the menses at 3 months after the delivery. Cesarean section was related to L (coefficient, 0.370; t-value, 2.414; $p = 0.016$) and W (0.345; 3.213; $p = 0.0015$) at one month after the delivery. The breast-feeding rate at 3 months after the delivery (coefficient, -0.009 ; t-value, -4.980 ; $p < 0.0001$), the restoration of the menses at 3 months after the delivery (0.445; 3.383; $p = 0.0008$, respectively), the history of cesarean section (0.385; 2.783; $p = 0.0057$, respectively), and parity (0.170; 2.339; $p = 0.02$, respectively) were related to L at 3 months after the delivery. The breast-feeding rate at 3 months after the delivery (coefficient, -0.006 ; t-value, -7.765 ; $p < 0.001$) was related to W at 3 months after the delivery.

Discussion

Changes in uterine size measured by a simple and noninvasive means, transvaginal US, after vaginal delivery and cesarean section were evaluated at one and three months after delivery. Both US and MRI [7, 8] have been used to study the puerperal uterus during the first 2 weeks post partum, and have revealed a dynamic involution process [2, 4, 5]. We conducted this study to serially document the normal involution of the postpartum uterus during the first 3 months after delivery, thereby furthering our understanding of this process.

The association between breast-feeding and recovery of the uterus was also examined. There was no significant difference in uterine size between breast- or bottle-feeding mothers at one month after delivery in our investigation. However, a difference in uterine size related to feeding methods was found at 3 months after delivery. The fact that the mean breast-feeding rate in the VD group (52.8%) at three months was higher than in the CS group (39.4%) may partially explain the difference in uterine size between the two groups at 3 months after delivery (Fig. 2). Van Rees [5] reported that the decrease in uterine size was related to a diminution in uterine length and that they found no difference between breast- and bottle-feeding mothers in examinations between 1 and 40 days post partum. Their findings are the same as ours one month after delivery. Defoort et al. [1] and Wachsberg et al. [6] also reported the absence of any relation between uterine involution and breast-feeding. However, there was a clear difference between puerperants who breast-fed immediately after birth and those who resorted to artificial methods: uterine volume diminished more rapidly in the former, especially between days 1–4 [3].

The uterine size was significantly larger in women who restored menses at 3 months after the delivery than those who did not restore menses. However, the uterine size is more associated with the breast-feeding rate than the menses restoration at 3 months after the delivery in VD group according to the stepwise regression analysis.

Increasing maternal parity was associated slightly, but not significantly, with greater uterine length up to 3 months postpartum in our investigation. This finding is consistent with Wachsberg' results [6]. In our investigation, however, the decrease in uterine width was prolonged as its parity increased.

Normal involution after vaginal delivery was shown to occur more rapidly at one month (L) and at 3 months (L and W) than after cesarean section. No difference in uterine diameter was observed between patients after cesarean section and after normal childbirth until day 8 postpartum [3]. This finding suggests that the earlier ambulation in the VD group than the CS group may not be responsible for the difference in uterine size, but some other factors may affect the different size of the uterus between the VD group and the CS group at one and 3 months postpartum.

In conclusion, there have been few reports on postpartum changes in the uterus measured by vaginal sonography. We evaluate the involution of the postpartum uterus at one and 3 months after delivery according to the delivery method, the feeding method, menses restoration, and parity. Delivery mode was related to the uter-

ine size at one month postpartum. The rate of breast-feeding was mostly related to the uterine size at 3 months postpartum.

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